

1021.43049X00
Serial No. 10/644,022
Office Action dated June 30, 2006

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SEP 29 2006

REMARKS

I. Introduction

By the present Amendment, claims 1, 2, 8, 9, 16, and 18-20 have been amended. Claims 13, 14, and 17 have been withdrawn from consideration. No claims have been added or canceled. Accordingly, claims 1-22 remain pending in the application. Claims 1, 2, 18, and 19 are independent.

II. Office Action Summary

In the Office Action of June 30, 2006, the Abstract of the Disclosure was objected to under 37 CFR 1.72(b). The specification was objected to because of various informalities. Claims 8, 9, 16, 18, and 19 were objected to because of various informalities. Claim 20 was rejected under 35 USC §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter regarded as the invention. Claims 1-8, 11, 15, 18, 19, and 22 were rejected under 35 USC §102(e) as being anticipated by U.S. Patent 7,057,837 issued to Gill. Claims 10 and 16 were rejected under 35 USC §103(a) as being unpatentable over Gill. Claim 21 was rejected under 35 USC §103(a) as being unpatentable over Gill in view of U.S. Patent Application 2003/002023 to Carey, et al. ("Carey"). These rejections are respectfully traversed.

The Examiner's indication that claims 9 and 12 would be allowable, if rewritten in independent form to include all of the limitations of the base claim and any intervening claims, is noted with appreciation.

1021.43049X00
Serial No. 10/644,022
Office Action dated June 30, 2006

III. Objections to the Specification

The Abstract was objected to under 37 CFR 1.72(b). Regarding this objection, the Office Action indicates that the length of the Abstract exceeds the limit of 150 words. The Office Action also indicates that the current Abstract appears to be 160 words.

Concurrently submitted herewith, is a substitute Abstract which has been revised to comply with the requirements of 37 CFR 1.72(b). Withdrawal of this objection is therefore respectfully requested.

The specification was objected to because of various informalities. Regarding this objection, the Office Action cites several instances of language that appeared to be incorrect and/or included typographical errors.

By the present Amendment, Applicants have made corrections to the specification to address the informalities identified in the Office Action. Withdrawal of this objection is therefore respectfully requested.

IV. Objections to the Claims

Claims 8, 9, 16, 18, and 19 were objected to because of various informalities. Regarding this objection, the Office Action cites various instances of language that contained typographical errors or confusing descriptions.

By the present Amendment, Applicants have amended these claims, in part, to address the issues identified in the Office Action.

Withdrawal of this objection is therefore respectfully requested.

V. Rejections under 35 USC §112

Claim 20 was rejected under 35 USC §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter

1021.43049X00
Serial No. 10/644,022
Office Action dated June 30, 2006

regarded as the invention. Regarding this rejection, the Office Action cites language that appeared confusing and/or otherwise indefinite.

By the present Amendment, Applicants have amended claim 20 to address the issues of indefiniteness raised in the Office Action. Withdrawal of this rejection is therefore respectfully requested.

VI. Rejections Under 35 USC §102

Claims 1-8, 11, 15, 18, 19, and 22 were rejected under 35 USC §102(e) as being anticipated by Gill. Regarding this rejection, the Office Action indicates that Gill discloses a thin film perpendicular magnetic recording head that comprises a main pole, a return path for supplying a magnetic flux to the main pole, and a conductive coil for excitation of the main pole and the return path. The Office Action indicates that the main pole has a magnetic pole width of 200 nanometers or less and possesses a magnetic multilayer that is made up of a high saturation flux density layer and a low saturation flux density layer. The Office Action further indicates that the high saturation flux density layer contains an Fe-Co alloy and that the direction of magnetism of a pair of the high saturation flux density layers facing each other by way of the low saturation flux density layer is an antiparallel arrangement in the magnetic multilayer. Applicants respectfully disagree.

As amended, independent claim 1 defines a thin film perpendicular magnetic recording head that comprises a main pole, a return path for supplying a magnetic flux to the main pole and a conductive coil for excitation of the main pole and the return path. According to the magnetic recording head:

said main pole has a magnetic pole width of 200 nanometers or less, and

1021.43049X00
Serial No. 10/644,022
Office Action dated June 30, 2006

said main pole possesses a magnetic multilayer made up of a high saturation flux density layer and a low saturation flux density layer,

said high saturation flux density layer contains an Fe-Co alloy, and

the direction of magnetism of a pair of said high saturation flux density layers facing each other by way of said low saturation flux density layer is an antiparallel arrangement in said magnetic multilayer by magnetostatic coupling between magnetization of said high saturation flux density layers.

According to the magnetic recording head of independent claim 1, the main pole has a magnetic pole width of 200 nanometers or less and the main pole possesses a magnetic multilayer that is made up of a high saturation flux density layer and a low saturation flux density layer. The high saturation flux density layer contains an Fe-Co alloy, and the direction of magnetism of a pair of the high saturation flux density layers facing each other by way of a low saturation flux density layer is in an antiparallel arrangement within the magnetic multilayer. Furthermore, magnetostatic coupling is utilized in the antiparallel arrangement of magnetization between the high saturation flux density layers in the main pole. Since magnetostatic coupling is utilized, magnetic permeability in the main pole is not decreased. Accordingly, it is possible to suppress erasure problems that can occur at a signal magnet pole head without decreasing recording efficiency.

Gill discloses a single pole perpendicular write head for use with an ultra narrow track. The write head includes a layered structure alternating a plurality of ferromagnetic layers with a plurality of antiparallel coupling layers to form an antiparallel coupled ferromagnetic stack. Applicants' review of Gill, however, suggests that the antiparallel arrangement of magnetization between ferromagnetic

1021.43049X00
Serial No. 10/644,022
Office Action dated June 30, 2006

layers is achieved by alternately stacking ferromagnetic layers and antiparallel coupling (APC) layers. See col. 2, lines 7-48. When anti-ferromagnetic coupling is used between magnetic layers, however, magnetic permeability is decreased. Since the magnetic permeability effects the sensitivity of the magnetic material, the recording efficiency is consequently decreased. Gill does not appear to provide any disclosure for utilizing magnetostatic coupling in the antiparallel arrangement between individual magnetic layers as set forth in independent claim 1.

It is therefore respectfully submitted that independent claim 1 is allowable over the art of record.

Independent claim 22 depends from independent claim 1, and is therefore believed allowable for at least the reasons set forth above with respect to independent claim 1. In addition, this claim introduces novel elements that independently render it patentable over the art of record.

Independent claim 2 defines a thin film perpendicular magnetic recording head that comprises a main pole, a return path for supplying magnetic flux to the main pole, and a conductive coil for excitation of the main pole and the return path. According to the magnetic recording head:

said main pole has a magnetic pole width of 200 nanometers or less, said main pole possesses a magnetic multilayer made up of a high saturation flux density layer and a low saturation flux density layer,

the thickness of said low saturation flux density layer is within a range of 0.5 nanometers or more to 5 nanometers or less, and said high saturation flux density layer has a thickness from 10 nanometers or more to 50 nanometers or less, and

the direction of magnetism of a pair of said high saturation flux density layers facing each other by way of said low saturation flux density layer is an antiparallel arrangement in said magnetic

1021.43049X00
Serial No. 10/644,022
Office Action dated June 30, 2006

multilayer by magnetostatic coupling between magnetization of said high saturation flux density layers.

According to at least one feature of independent claim 2, the direction of magnetism of a pair of high saturation density layers facing each other by way of the low saturation flux density layer is in an antiparallel arrangement in the magnetic multilayer by magnetostatic coupling between magnetization of the high saturation flux density layers. As previously discussed, this particular feature is not disclosed by the art of record.

It is therefore respectfully submitted that independent claim 2 is allowable over the art of record.

Claims 3-12, 15, and 16 depend from independent claim 2, and are therefore believed allowable for at least the reasons set forth above with respect to Independent claim 2. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

Independent claim 18 defines a magnetic disk drive that comprises a magnetic recording medium, a thin film perpendicular magnetic recording head, and a positioning device for positioning the thin film perpendicular magnetic recording head on the magnetic recording medium, such that the magnetic disk drive supplies read and write electrical current to the thin film perpendicular magnetic recording head and encodes stored data and decodes reproduced data. According to the magnetic disk drive:

said thin film perpendicular magnetic recording head is composed of a main pole, a return path for supplying a magnetic flux to said main pole, and a conductive coil for excitation of said main pole and said return path, and said main pole has a magnetic pole width of 200 nanometers or less, and said main pole possesses a magnetic multilayer made up of a high saturation flux

1021.43049X00
Serial No. 10/644,022
Office Action dated June 30, 2006

density layer and a low saturation flux density layer, and the thickness of said low saturation flux density layer is within a range of 0.5 nanometers or more to 5 nanometers or less, and said high saturation flux density layer has a thickness from 10 nanometers or more to 50 nanometers or less;

the direction of magnetism of a pair of said high saturation flux density layers facing each other by way of said low saturation flux density layer is an antiparallel arrangement in said magnetic multilayer by magnetostatic coupling between magnetization of said high saturation flux density layers; and

said magnetic recording medium is composed of a recording layer made from ferromagnetic material of high coercive magnetic force for holding the written data by uniaxial magnetic anisotropy and, a flux keeper layer of low magnetic coercivity for assisting in generating a magnetic recording field by an interactive effect with said write element.

At least one feature of the magnetic disk drive of independent claim 18 is the manner in which the direction of magnetism of a pair of high saturation flux density layers in the thin film perpendicular magnetic recording head is arranged. This particular feature is similar to that of the magnetic recording head of independent claim 1. As previously indicated, the art of record does not provide any disclosure for features such as magnetostatic coupling between the high saturation flux density layers.

It is therefore respectfully submitted that independent claim 18 is allowable over the art of record.

Claims 20 and 21 depend from independent claim 18, and are therefore believed allowable for at least the reasons set forth above with respect to independent claim 18. In addition, these claims each introduce novel elements that independently render them patentable over the art of record.

1021.43049X00
Serial No. 10/644,022
Office Action dated June 30, 2006

Independent claim 19 defines a magnetic disk drive that comprises a magnetic recording medium, a thin film perpendicular magnetic recording head, and a positioner device for positioning the thin film magnetic recording head on the magnetic recording medium. The magnetic disk drive supplies a read and write electrical current to the thin film perpendicular magnetic recording head and encodes stored data and decodes reproduced data. According to at least one feature of independent claim 19, the direction of magnetism of a pair of the high saturation flux density layers facing each other by way of the low saturation flux density layer is in an antiparallel arrangement in the magnetic multilayer using magnetostatic coupling between the high saturation flux density layers.

As previously discussed with respect to independent claim 1, this particular feature is not shown or suggested by the art of record.

It is therefore respectfully submitted that independent claim 19 is allowable over the art of record.

VII. Rejections Under 35 USC §103

Claims 10, 16, and 21 were rejected under 35 USC §103(a) as being unpatentable over Gill either independently, or further in view of Carey.

As previously discussed, however, Gill fails to disclose features recited in independent claims 2 and 18. Additionally, these features are not obvious over Gill either alone or in combination with any secondary references.

Accordingly, these claims are further believed to be patentable over the art of record.

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SEP 29 2006

1021.43049X00

Serial No. 10/644,022

Office Action dated June 30, 2006

VIII. Conclusion

For the reasons stated above, it is respectfully submitted that all of the pending claims are now in condition for allowance. Therefore, the issuance of a Notice of Allowance is believed in order, and courteously solicited.

If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

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021/022

SEP 29 2006

1021.43049X00


Serial No. 10/644,022

Office Action dated June 30, 2006

AUTHORIZATION

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 1021.43049X00).

Respectfully submitted,
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Encl: Substitute Abstract